

**WE CLAIM:**

1. A method for measuring an absorption coefficient and a reduced scattering coefficient of a multiple scattering medium, comprising the steps of:
  - 5       outputting a coherent light beam, the coherent light beam including linear polarized P and S wave components having mutually orthogonal polarizations and frequencies  $\omega_p$  and  $\omega_s$ , respectively;
  - 10      splitting the coherent light beam into a signal beam and a reference beam, the signal beam and the reference beam including the P wave and S wave components, respectively;
  - 15      projecting the signal beam into the multiple scattering medium;
  - 20      detecting and converting an optical interference signal of the reference beam and an optical interference signal of the signal beam that penetrates the multiple scattering medium, respectively, into heterodyne interference electrical signals;
  - 25      comparing the two heterodyne interference electrical signals to obtain amplitude attenuation and phase delay of the signal beam that penetrated the multiple scattering medium; and
  - inferring the reduced scattering coefficient and the absorption coefficient of the multiple scattering medium at a position where the multiple scattering medium is penetrated with reference to the amplitude

attenuation and phase delay thus obtained.

2. The method of Claim 1, wherein the coherent light beam is emitted from a linear polarized frequency stabilized two-frequency laser light source.

5 3. The method of Claim 1, wherein the coherent light beam is emitted from a circular polarized frequency stabilized two-frequency laser light source.

10 4. The method of Claim 1, further comprising a step of concentrating the signal beam to a signal optical fiber prior to projection of the signal beam into the multiple scattering medium; the signal beam that penetrated the multiple scattering medium being detected by means of a detector optical fiber.

15 5. The method of Claim 4, further comprising steps of amplifying and filtering after detecting the optical interference signal of the signal beam that penetrated the multiple scattering medium for conversion into the heterodyne interference electrical signal.

20 6. The method of Claim 1, wherein the splitting step includes a sub-step of generating a photon pair, in which the coherent light beam is passed through a polarizer to become a correlated parallel linear polarized photon pair and a sub-step of beam separation, in which a beam splitter splits the photon pair thus generated into the reference beam and the signal beam.

25 7. The method of Claim 1, further comprising a step of band-pass filtering prior to the step of comparing the

heterodyne interference electrical signals, in which  
a frequency difference of  $\omega_p$  and  $\omega_s$  serves as a center  
frequency for band-pass filtering of the heterodyne  
interference electrical signal converted from the  
5 signal beam that penetrated the multiple scattering  
medium.

8. The method of Claim 1, wherein the step of detecting  
the optical interference signal of the signal beam that  
penetrated the multiple scattering medium includes a  
10 sub-step of splitting the optical interference signal  
of the signal beam that penetrated the multiple  
scattering medium into two mutually orthogonal  
polarization directions for subsequent detection and  
conversion into the heterodyne interference electrical  
15 signals, and a sub-step of subsequently inputting the  
heterodyne interference electrical signals into a  
differential amplifier.

9. A method of imaging a multiple scattering medium,  
comprising the steps of:

20 outputting a coherent light beam, the coherent light  
beam including linear polarized P and S wave components  
having mutually orthogonal polarizations and  
different frequencies;

25 splitting the coherent light beam into a signal beam  
and a reference beam, the signal beam and the reference  
beam including the P wave and S wave components,  
respectively;

projecting the signal beam into the multiple scattering medium;

detecting an optical interference signal of the reference beam and an optical interference signal of  
5 the signal beam that penetrated the multiple scattering medium for conversion into heterodyne interference electrical signals;

10 comparing the two heterodyne interference electrical signals to obtain amplitude attenuation and phase delay of the signal beam that penetrated the multiple scattering medium;

inferring a reduced scattering coefficient and an absorption coefficient of the multiple scattering medium at a penetration position;

15 recording the reduced scattering coefficient, the absorption coefficient and information of the penetration position;

20 moving the position of incidence of the signal beam and detecting the position of the signal beam that penetrated the multiple scattering medium, and repeating the foregoing steps for a predetermined number of times; and

25 according to the positions of penetration, reconstructing distribution of the reduced scattering coefficients and absorption coefficients of the positions.